LMS/BON/48830

2024 Inspection and Status Report for the Boiling Nuclear Superheater (BONUS) Decommissioned Reactor Site, Rincón, Puerto Rico

September 2024

U.S. DEPARTMENT OF ENERGY | Legacy Management

Contents

Table

Appendix

Abbreviations

BONUS	Boiling Nuclear Superheater
DOE	U.S. Department of Energy
LM	Office of Legacy Management
LMS	Legacy Management Support
LTS&M Plan	Long-Term Surveillance and Maintenance Plan
PL	photograph location
PREPA	Puerto Rico Electric Power Authority
RSI	RSI EnTech, LLC

Executive Summary

The Boiling Nuclear Superheater (BONUS) Decommissioned Reactor Site, on the west coast of Puerto Rico near the town of Rincón, was inspected on July 16 and 17, 2024. The inspection included checking the integrity of the entombed reactor system and the containment building, assessing site security and general housekeeping, and checking the condition of the surrounding land. With the assistance of the U.S. Department of Energy (DOE) Legacy Management Support (LMS) contractor's Environmental and Geospatial Data Management department, the inspection this year also included use of a Mobile Mapping Applications Program to collect and archive geospatial data from the site.

In addition, effective in 2024, the responsibility to conduct the annual radiological survey was transferred from the Puerto Rico Electric Power Authority (PREPA) to the DOE Office of Legacy Management (LM). The survey was conducted during the same period as the site inspection. The 2024 radiological survey results are covered under a separate report.

The integrity of the entombed reactor system was in excellent condition during this year's inspection. No cause for a follow-up inspection was identified. PREPA personnel have done an excellent job responding to maintenance items and recommendations from previous site inspections and working through the added demands placed on the island and the operation of the BONUS facility due to COVID-19.

The condition of the exterior of the site is much improved since the last site inspection in 2022. The site security fence remains in poor condition, but it is serviceable. Gaps in the fence fabric noted in 2022 were patched and no breach in the fence was present.

During the 2022 inspection, it was noted that the retaining wall on the west side of the property had collapsed, and that repair and stabilization of this retaining wall was an action required by PREPA as the site owner. During this year's inspection, it was observed that a new retaining wall was under construction. The new wall is located uphill, which is a higher location from the damaged wall, which will remain in place. Once completed, the new wall with fencing atop will secure this area of the site from trespass. Moving the location of this wall was well thought out and should serve to protect the west side of the property from trespass for years to come.

1.0 Introduction

This report presents the findings from the U.S. Department of Energy (DOE) Office of Legacy Management (LM) inspection of the Boiling Nuclear Superheater (BONUS) Decommissioned Reactor Site near Rincón, Puerto Rico, on July 16 and 17, 2024.

RSI EnTech, LLC (RSI), the Legacy Management Support (LMS) contractor, and specifically the LMS site lead and an LMS assistant inspector, conducted the site inspection. Effective in 2024, the responsibility to conduct the annual radiological survey was transferred from the Puerto Rico Electric Power Authority (PREPA) to LM. The survey was conducted during the same period as the site inspection. The 2024 radiological survey results are presented in a separate report.

At the same time that the inspection was taking place, a separate LMS team conducted the routine annual radiological survey of the entombment area. In the past, this radiological survey was coordinated by PREPA and conducted using a separate subcontractor from Oak Ridge, Tennessee. DOE now has responsibility for coordinating and conducting the annual radiological survey. PREPA personnel served as escorts at the BONUS site.

The 2024 site inspection was conducted in accordance with the *Long-Term Surveillance and Maintenance Plan for the Boiling Nuclear Superheater (BONUS) Reactor Facility, Rincón, Puerto Rico* (DOE 2023), also referred to as the BONUS Long-Term Surveillance and Maintenance Plan (LTS&M Plan), and with procedures established by RSI for site inspections. The primary purpose for the inspection was to confirm the integrity of the entombed reactor and the building that contains the entombed reactor. Additional objectives included assessing site security, the general housekeeping of the site, and any changes in the surrounding area that might adversely impact the long-term sustainability of the facility.

Section 4.3 of the BONUS LTS&M Plan prescribes the LM site inspection requirements, which are described in the table below.

Inspection Requirement	BONUS LTS&M Plan Section	Status
Contact PREPA	4.3	PREPA was contacted in advance of the visit.
Contact the mayor of Rincón	4.3	The mayor was contacted in advance of the visit.
Prepare and follow an inspection checklist	4.3.1	The checklist was prepared in advance of the visit.

As part of the pre-job briefing in advance of the inspection, personnel reviewed and signed the job safety analysis for the site inspection at the BONUS site.

The BONUS facility consists of the containment building (which houses the entombed reactor system) and separate support buildings. PREPA uses the decommissioned BONUS facility as a museum that is open to the public for scheduled tours. Before the 2017 hurricane, approximately five to six tours were conducted each year. Museum tours were suspended while the site was without power. Currently, site tours are limited due to availability of PREPA personnel.

DOE retains responsibility for the entombed radioactive materials that remain at the BONUS facility. In 2003, DOE conducted an Environmental Assessment and concluded that there was no unacceptable risk to human health or the environment from fixed radioactive contaminated areas. This conclusion was published in the *Finding of No Significant Impact for Authorizing the Puerto Rico Electric Power Authority (PREPA) to Allow Public Access to the Boiling Nuclear Superheat (BONUS) Reactor Building, Rincón, Puerto Rico* (DOE 2003). However, there are limited and discrete areas within the museum building that have fixed residual radioactive contamination, and these areas are isolated, shielded, and posted to protect visitors and workers. Radiation surveys of the facility are conducted quarterly by PREPA staff and, up until this year, annually by a third-party subcontractor. Effective in 2024, the responsibility for coordinating and conducting the annual radiological survey was transferred from PREPA to LM. The most recent annual radiological survey was conducted in July 2024 concurrent with the annual site inspection. Results of the annual radiological survey conducted this year will be reported in a standalone report.

2.0 Inspection Results

Features discussed in this report are shown on the attached site drawings (Appendix A). Photographs to support specific observations are identified in the text and on the site drawings by photograph location (PL) numbers. Inspection items, issues, actions, observations, and recommendations for 2024 are provided in Table 1 and discussed below.

Effective in 2024, with the assistance of the LMS Environmental and Geospatial Data Management department, a Mobile Mapping Applications Program was used to collect and archive geospatial data from the site. This method of data collection will be utilized in future site inspections.

Table 1. 2024 Inspection Items, Issues, Actions, Observations, and Recommendations

No.	Item	Issue	Action	2024 Inspection Observations and Recommendations
1	Access	Site security and access accountability.	Inspectors need to sign in on the required log sheet at the security gate upon arrival.	The site security guard met the team at the access gate and the inspection team signed the required log sheet.
2	Specific site surveillance features	In addition to the information in this row, see site-specific surveillance features listed below in this table.	Inspect the following: • Roads and parking area • Entrance gate • Access through the security gate • Security fence • Retaining wall along beach • Enclosed domed building and monolith plaques	• The roads and parking area were in good shape. • The entrance gate was in good shape. • There were no issues with access through the security gate. • The security fence remains damaged from the hurricanes in 2017 but was much improved from the 2022 inspection. All fabric in the fence has been repaired, leaving no open gaps. Top rails and barbed wire remained damaged in several areas, though. Overall, the fence remains serviceable but in need of additional repairs. • A new wall was under construction at the time of this year's inspection. It was moved from the original location. It is now located up the hill, closer to the site. The new location was well thought out and should serve the site well for years to come. • The enclosed dome and monolith plaques were in good shape.
3	Enclosed domed building—entombed concrete monolith and monolith penetrations	Structural defects or degradation can result in loss of containment or radioactive materials.	Inspect for possible indications of structural problems, such as cracking, staining, and spalling.	The entombed reactor system was found to be in excellent condition. No indications of structural problems, such as cracking, staining, or spalling, were identified on the entombed concrete monolith and monolith penetrations.
4	Enclosed domed building—external piping systems	Systems were flushed during decommissioning. Incidental contamination remains, which might be released if systems corrode or otherwise fail.	Inspect for possible indications of deterioration, such as peeling and blistering paint, staining, and flaking.	External piping systems showed no signs of deterioration, such as peeling and blistering paint, staining, and flaking.

Table 1. 2024 Inspection Items, Issues, Actions, Observations, and Recommendations (continued)

No.	Item	Issue	Action	2024 Inspection Observations and Recommendations
5	Enclosed domed building—basement	Some areas contain radiological contamination in excess of DOE standards; the general public is not allowed access to contaminated areas.	Note the condition of access control barricades.	Access control barricades to the basement were in place and in good order.
		In November 2018, PREPA conducted a radiation survey that discovered removable contamination at the base of a condensation pump in the Condensate Pump Room of the basement. The contamination consisted of approximately two handfuls of rust debris stained with oil. It is believed that the contamination is somehow related to the 2017 storm events. Contamination was fixed in place with an epoxy material.	Observe the posting as a contamination area (rope and signage). Inspect the fixed contamination in the Condensate Pump Room.	Access to contamination was being properly managed and controlled. Postings were correct. The contamination that was fixed in place in the Condensate Pump Room with an epoxy material remains undisturbed. DOE placed more epoxy atop the previously elevated rust debris to strengthen the encapsulation as part of the annual radiological survey. A small area of fluid was observed at the base of the Gen. Seal Oil Filter No. 1 in the basement of the containment building. DOE further assessed the radiological nature of this fluid as part of this year's annual radiological survey.
		Asbestos pipe insulation exists throughout the basement, but PREPA asbestos-certified personnel have inventoried the pipe installation and stabilized it in place. In accordance with the BONUS LTS&M Plan, asbestos inspections are performed quarterly, and air sampling is performed annually by PREPA staff or contractors. Vinyl floor tiles in two interior rooms (lab and control room) are suspect ACM given their age and dimensions. The corners of many of the tiles are beginning to curl due to age. The ”mastic” glue used at the time the floor tiles were installed may also contain ACM. These areas are currently isolated from foot traffic.	Visually assess piping where available. Discuss current findings from quarterly asbestos inspections and annual air samplings with PREPA personnel.	Visual assessment confirmed that asbestos pipe insulation continues to be managed properly (non-friable condition). Visual assessment of the floor tiles indicates that caution is warranted, and that PREPA should continue prohibiting foot traffic on the suspect tiles. It is recommended that PREPA consider further investigation into the presence of asbestos in the floor tiles and tile mastic.

Table 1. 2024 Inspection Items, Issues, Actions, Observations, and Recommendations (continued)

No.	Item	Issue	Action	2024 Inspection Observations and Recommendations
6	Enclosed domed building—basement flooding	Water accumulating in the basement might mobilize and redistribute surface contamination. The basement flooded in 1998 due to Hurricane Georges. After that flood, stormwater drains were unplugged, and the rubber door seals were replaced.	Inspect rubber door seals and stormwater drains.	No water was present on the basement floor. The basement floor was exceptionally clean.
7	Enclosed domed building—main floor	Some areas contain radiological contamination in excess of DOE standards; the general public is not allowed access to contaminated areas.	Note the condition of access control barricades, ceramic floor tile, and lead blocks; note general housekeeping. Check to see if access to stairways leading to the basement level is being effectively maintained and controlled to keep out the public.	Access control barricades on the main floor were in place and in good order. Ceramic floor tiles and lead blocks were in good shape. General housekeeping was excellent. Stairways leading to the basement level were being effectively maintained and controlled to keep the public out. An opening in the side of Airlock 2 has what appears to be an electric cord running through it. This was first observed during the 2022 inspection. This opening remains in the wall and should be closed.
8	Enclosed domed building—mezzanine	Some areas contain radiological contamination in excess of DOE standards; the general public is not allowed access to contaminated areas.	Note the condition of access control to the mezzanine; note general housekeeping.	Access control barricades to the mezzanine were in place and in good order. General housekeeping was excellent.
9	Enclosed domed building—exterior	Building should appear well maintained. In 2013, the outer surface of the containment dome was repainted. In 2013, the rubber seal at the base of the containment dome was repaired.	Visually inspect the exterior of the building.	The outer surface of the dome was in excellent condition with the exception of a few small areas that needs to be repainted due to 2017 hurricane damage. A secondary rubber seal installed at the base of the containment building is functioning properly but beginning to show signs of wear. Surface damage on seals appears to be caused by water ponding and evaporating. To better ensure long-term integrity of the seal, overlaps of the secondary seal have been caulked, and the ends of the seal have been better attached to the wall of the containment building dome. What appears to be damage to the molding that connects the containment dome to the auxiliary building was observed. The molding appears to remain functional.

Table 1. 2024 Inspection Items, Issues, Actions, Observations, and Recommendations (continued)

No.	Item	Issue	Action	2024 Inspection Observations and Recommendations
10	Surrounding land	New or changing features or activities adjacent to the site can affect site security. The retaining wall located along the west side of the property (along the beach) is heavily damaged and needs to be rebuilt.	Note changes within 0.25 mile (400 meters) of the site.	The perimeter security fence is in poor condition. The fence fabric has been repaired, and no gaps were observed. The top rail and barbed wire are damaged in several locations. A new retaining wall and security fence were under construction at the time of the inspection. The wall has been moved uphill from its original location. The new location was well thought out and should serve its purpose for years to come. The site drainage culverts were clear of debris.
11	General site upkeep	The building should appear well maintained.	Observe and evaluate changes in site conditions.	General housekeeping around the site was excellent. Areas between buildings and along the fence line were free of trash. The auditorium and patio area were in good shape and were being used by PREPA. The training center was not being used, and the interior was exposed to the elements. Ventilation and humidity levels within the containment dome and museum continue to be a challenge. Many excellent museum displays are in danger of being damaged due to the lack of better controlled temperatures and humidity levels.
12	Site security	A security guard should be stationed at all times.	Ensure that a security guard is present.	A security guard was present during the inspection.
13	Erosion	Ensure that hill slopes and the beach adjacent to the site are not actively eroding in a way that could adversely affect the facility.	Evaluate erosional features on the adjacent slopes and beach.	The hill slopes and beach adjacent to the site were not actively eroding in a way that could adversely affect the facility.

Abbreviation:
ACM = asbestos-containing material

2.1 Containment Building and Entombed Reactor System

The containment building houses the entombed reactor system. The dome of the containment building has a diameter of approximately 160 feet and a circumference of approximately 502 feet. The entombed reactor system within the containment dome was found to be in excellent condition, and its integrity was confirmed. No indications of structural problems, such as cracking, staining, or spalling, were identified on the entombed concrete monolith and monolith penetrations. External piping systems showed no signs of deterioration, such as peeling and blistering paint, staining, and flaking.

Access control barricades in the basement, on the main floor, and on the mezzanine were in place and in good order. The basement was very clean and there was no water present on the basement floor.

Inspectors observed that an opening in the side of Airlock 2 has what appears to be an electric cord running through it. This opening should be closed to protect the interior of the containment dome (PL-1).

The outer surface of the dome was reconditioned and painted in 2013 (PL-2) (PL-3). Paint in a few areas of the dome was damaged during the 2017 hurricanes and needs to be repainted.

A rubber seal is installed around the base of the containment dome to keep water from seeping into the building. In 2010, the seal was observed to be cracked, ripped, and missing in some spots. Evidence of water seepage was observed in a few spots along the top of the basement wall inside the containment dome, which indicated that the seal was leaking in those areas. PREPA installed a secondary rubber seal over the damaged primary seal to carry water away from the underlying damaged seal. Water can collect on top of the seal and then evaporate (PL-3). It is believed that water collected in this way serves to weaken the integrity of the seal. Should this continue, a fix may be needed in the future to correct this situation. No evidence of recent water seepage was observed along the top of the basement wall in the containment building during this year's inspection, which indicates that the secondary seal is functioning properly.

In November 2018, PREPA conducted a radiation survey and discovered removable contamination in the basement at the base of a condensation pump in the Condensate Pump Room. The contamination consisted of approximately two handfuls of rust debris stained with oil. It is believed that the presence of the rust material is somehow connected to the two hurricane storm events in 2017. The rust debris has been safely encapsulated (sealed) in an epoxy material, which was observed to be intact and undisturbed. As part of this year's annual radiation survey, DOE placed more epoxy across the top of this area to strengthen the encapsulation.

Bird nests were observed in the Airlock 1 (PL-4). It is recommended that these bird nests be removed.

2.2 Site Security

Site security consists of a guard shack that is staffed around the clock, a motor-operated entrance gate (24 feet wide), and a security fence (i.e., a 6-foot-high chain-link fence topped with three strands of barbed wire) that encloses approximately 5 acres.

Upon arrival, the security guard was present, and the gate was closed and locked. The on-duty security guard allowed the inspection team to enter the grounds. The perimeter security fence was found to be in poor condition. The fabric of the fence had been repaired in several areas (PL-5). No openings or gaps were observed in the fence fabric. The top rail in many areas was bent or damaged. Barbed wire was missing along most of the fence (PL-6). It is recommended that the fence be further repaired if funding becomes available.

2.3 Support Facilities

Support facilities (auditorium, patio area, and training center) are on the west side of the property. The support buildings have no effect on the integrity of the containment building entombment but were inspected to get a better understanding of their present condition and potential future use.

The auditorium was in good condition and was being used by PREPA. It consists of a stage area with seating for approximately 100. The patio area is just outside of the auditorium. It was in good condition and was also being used by PREPA on an as-needed basis. The training center was not being used. For safety reasons, the inspection team did not go inside the training center.

The new retaining wall with security fence atop was being installed just west of the support facilities area during the time of the inspection (PL-7 and PL-8). The new location of the wall and fence was well thought out and should serve to protect this area of the site from trespass for years to come.

2.4 General Housekeeping

General housekeeping around the site was excellent. Areas between buildings and along the fence line were free of trash. Except for vegetation damage from the 2017 hurricanes, the landscaping was well maintained.

Ventilation and humidity levels within the containment building continue to be a challenge. Many of the excellent museum displays were showing wear due to poor ventilation and humidity. Many of the exhibits are in danger of being permanently damaged if conditions are not improved.

2.5 Surrounding Area

Storm drains leading from the site were found to be clear and free of debris (PL-9). The beach west of the facility is readily utilized by the public.

3.0 Recommendations

The following recommendations are made for the site:

- A few small areas of the dome should be repainted to help protect the dome from corrosion.
- Remaining hurricane damage to the perimeter fence should be repaired. PREPA should consider replacing the fence should funding become available.
- The opening in Airlock 2 should be closed.

4.0 Photographs

PL Number	Azimuth	Photograph Description
PL-1	—	Opening to outside in Airlock 2
PL-2	360	Containment dome
PL-3	—	Seal along base of dome
PL-4	—	Bird nests in Airlock 1
PL-5	180	Perimeter fence repair
PL-6	90	Damaged perimeter fence
PL-7	240	New perimeter wall and fence
PL-8	310	New perimeter wall and fence
PL-9	90	Drain culvert

Note:
— = Photograph taken vertically from above.

PL-1. Opening to Outside in Airlock 2

PL-2. Containment Dome

PL-3. Seal Along Base of Dome

PL-4. Bird Nests in Airlock 1

PL-5. Perimeter Fence Repair

PL-6. Damaged Perimeter Fence

PL-7. New Perimeter Wall and Fence

PL-8. New Perimeter Wall and Fence

PL-9. Drain Culvert

5.0 References

DOE (U.S. Department of Energy), 2003. *Finding of No Significant Impact for Authorizing the Puerto Rico Electric Power Authority (PREPA) to Allow Public Access to the Boiling Nuclear Superheat (BONUS) Reactor Building, Rincón, Puerto Rico,* FONSI DOE/EA-1394, Oak Ridge Operations Office, January.

DOE (U.S. Department of Energy), 2023. *Long-Term Surveillance and Maintenance Plan for the Boiling Nuclear Superheater (BONUS) Reactor Facility, Rincón, Puerto Rico,* LMS/BON/S01091-2.0, Office of Legacy Management, August.

Appendix A

2024 Annual Inspection Site Drawings

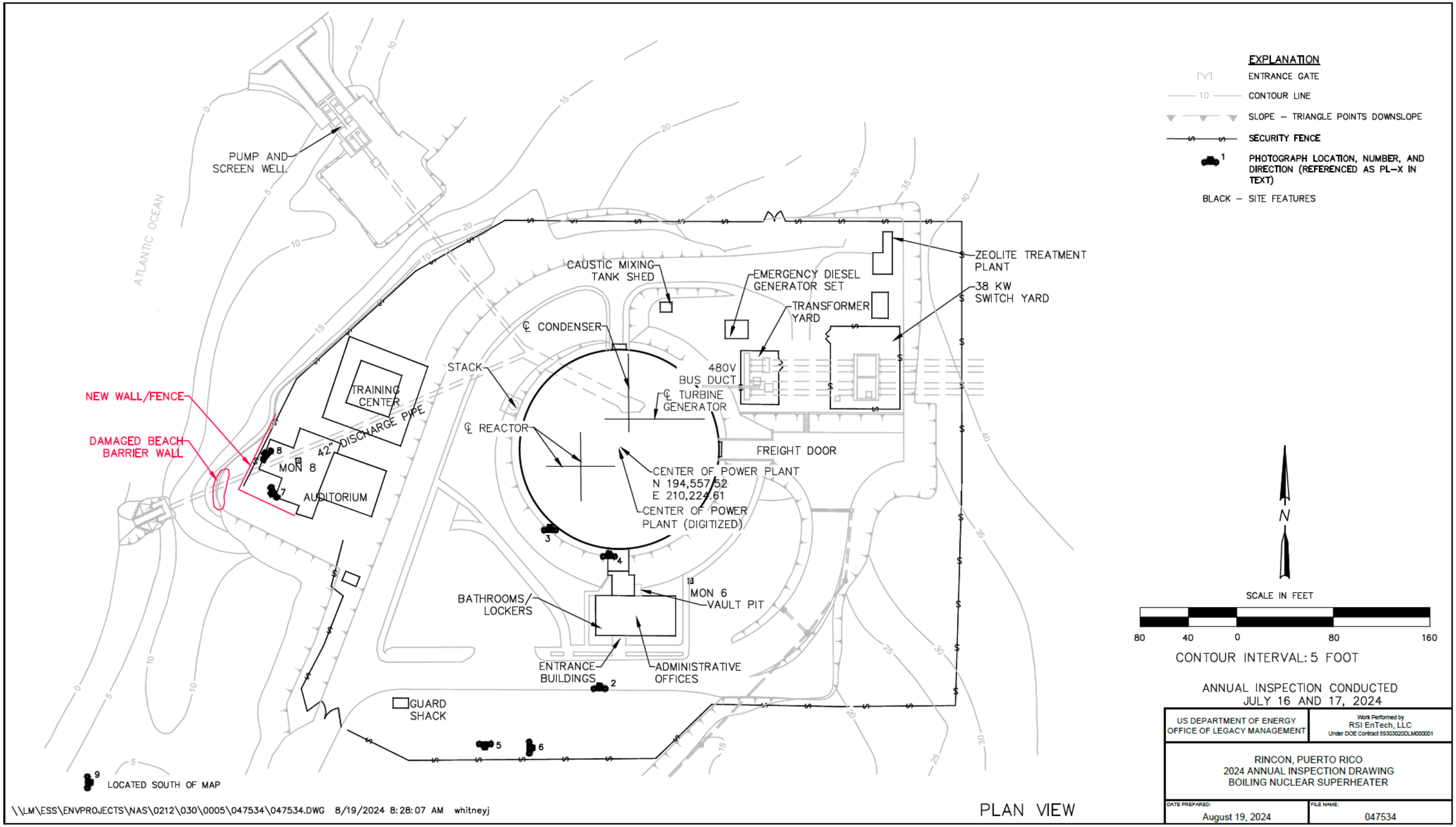

Figure A-1. 2024 Annual Inspection Drawing, Plan View, Rincón, Puerto Rico, BONUS Site

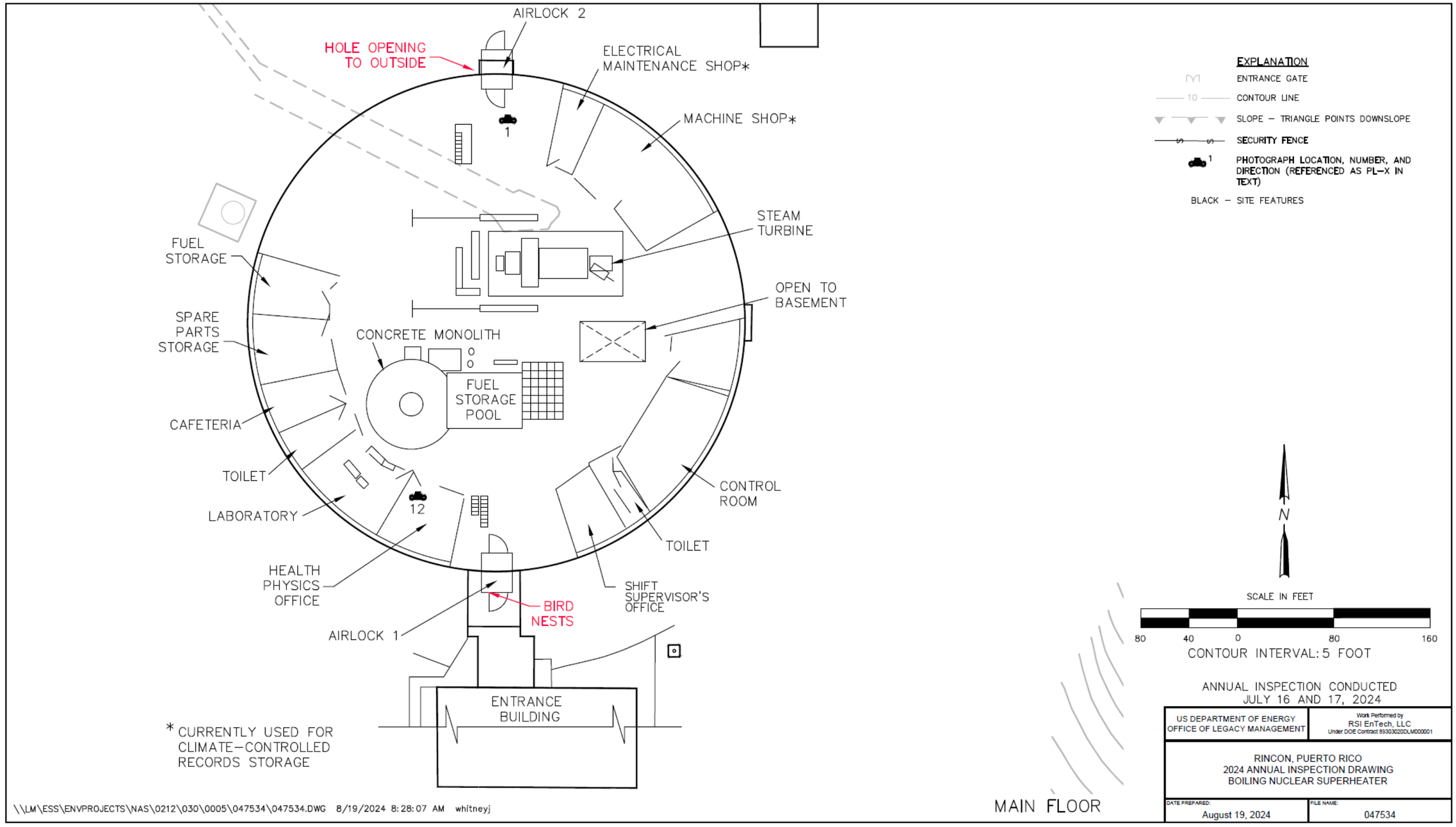

Figure A-2. 2024 Annual Inspection Drawing, Main Floor, Rincón, Puerto Rico, BONUS Site

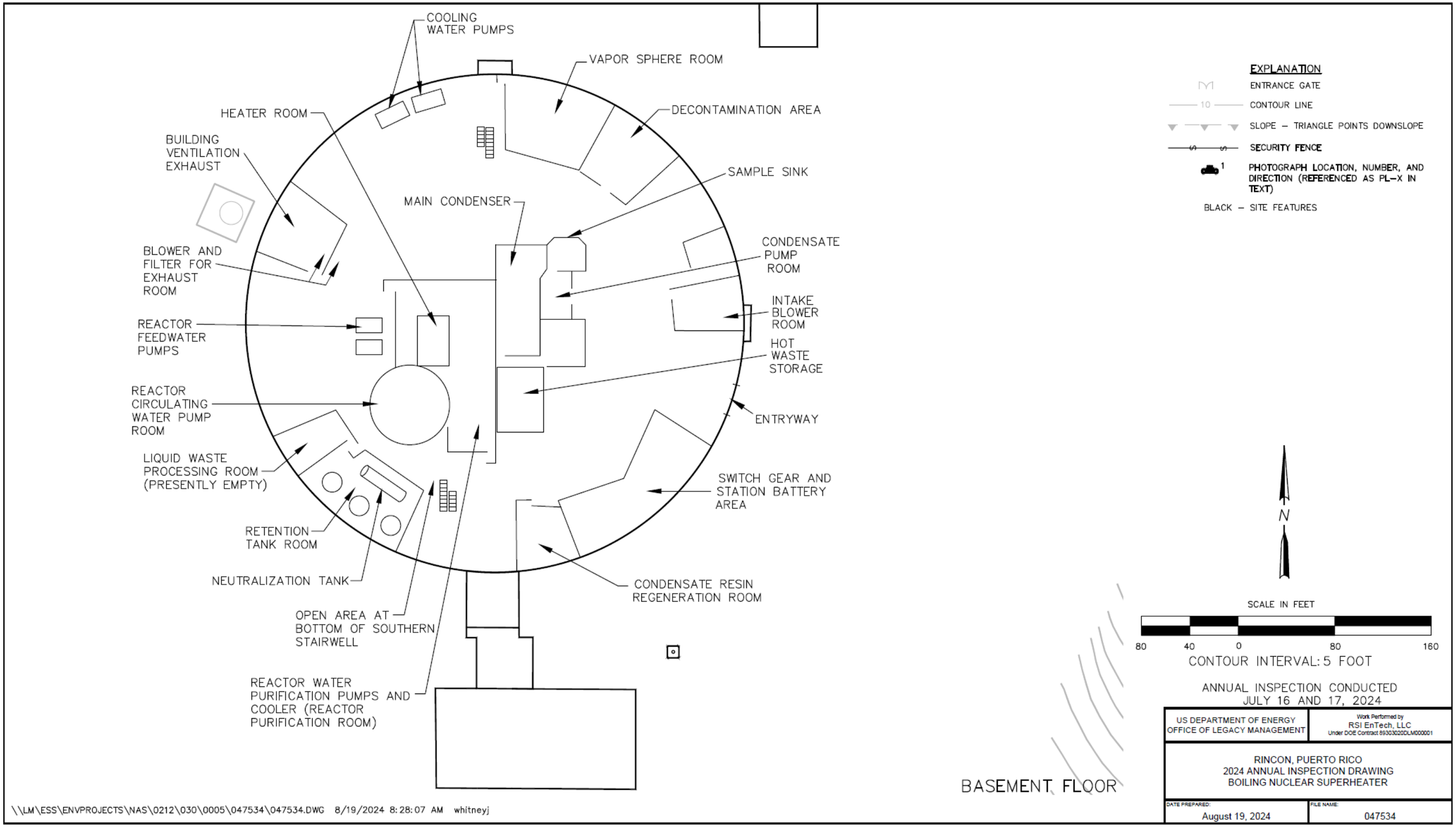

Figure A-3. 2024 Annual Inspection Drawing, Basement Floor, Rincón, Puerto Rico, BONUS Site